CEM EXAM REVIEW QUESTIONS

Some of these review questions may be more complex or difficult than the exam but will be good practice problems.

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1. An alternative refrigerant to CFC-114 is HCFC-124?
   (A) True
   (B) False
2. Participation in the Marching Grants Program for Schools and Hospitals, as authorized in the National Energy Conservation Policy Act (NECPA), requires an 80% match of funds from the recipient institutions except in hardship cases.
   (A) True
   (B) False
3. If electricity is selling for $0.06 per kilowatt-hour and is used for electric heating with an efficiency of 100%, what is the equivalent price of natural gas per therm if it can be burned with an efficiency of 80%?
   (A) $1.30/therm
   (B) $1.40/therm
   (C) $1.50/therm
   (D) $1.60/therm
   (E) $1.70/therm
4. An energy saving device will save $25,000 per year for 8 years. How much can a company pay for this device if the interest rate (discount rate) is 15%?
5. What would be used to find the quantity of electric current in an AC circuit?
   (A) Ohmmeter
   (B) Ammeter
   (C) Wattmeter
   (D) All of the above
6. An audit for one firm showed that the power factor is almost always 70% and that the demand is 1000kW. What capacitor size is needed to correct power factor to 90%.
   (A) 266 kVAR
   (B) 536 kVAR
   (C) 1000kVAR
   (D) 618kVAR
   (E) 1214 kVAR
7. The amount of reactive power that must be supplied by capacitors to correct a power factor of 84% to 95% in a 400 HP motor at 75% load and 98% efficiency is:
   (A) At the inductive load
   (B) At load control centers
   (C) At the primary transformer

(D) All of the above
(E) A & B

8. Power factor correcting capacitors may be located:
   (A) At the inductive load
   (B) At load control centers
   (C) At the primary transformer
   (D) All of the above
   (E) A & B

9. You find that you can replace a 50 HP motor with a 5 HP motor by cutting the total air flow requirements. Calculate the total dollar savings, given the information below:

Runtime:	8,760 hours/year
Motor Efficiency:	90% (both motors)
Electrical Rate:	$9.00/KW-month
	$0.05/KW-hr
	$0.005/KW-hr

   Fuel Cost Adjustment:
   (A) $22,000
   (B) $12,710
   (C) $18,798
   (D) $15,650
   (E) $9,874

10. An absorption system with a COP of 0.8 is powered by hot water that enters at 200 F and exits at 180 F at a rate of 25 gpm. The chilled water operates on a 10 F temperature difference and the condenser water on a 20 F temperature difference. Calculate the Chilled water flow.
   (A) 10 gpm
   (B) 20 gpm
   (C) 40 gpm
   (D) 45 gpm
   (E) 30 gpm

11. 10,000 cfm of air leaves an air handler at 50 F, it is delivered to a room at 65 F. How many BTU/hr was lost in the ductwork?
   (A) 162,000 BTU/hr
   (B) 75,000 BTU/hr
   (C) 126,550 BTU/hr
   (D) 256,000 BTU/hr
   (E) 10,000 BTU/hr

12. Which of the following is not a positive displacement air compressor?
   (A) Helical Compressor
   (B) Reciprocating Compressor
   (C) Vane Compressor
   (D) Axial Compressor
   (E) None of the above

13. Air at 69 F dry bulb and 50% relative humidity flows at 6750 cubic feet per minute and is heated to 90 F dry bulb. How many BTU/hr is required in this process?
(A) 50,000 BTU/hr
(B) 75,000 BTU/hr
(C) 150,000 BTU/hr
(D) 10,000 BTU/hr

14. Estimate the seasonal energy consumption for a building if its design-heating load has been determined to be 350,000 BTU/hr for a design temperature difference of 70 F if the heating season has 3,500-degree days. The heating unit efficiency is 80%. Assume 1 MCF = 10^6 BTU.
(A) 625 MCF/year
(B) 350 MCF/year
(C) 420 MCF/year
(D) 656 MCF/year
(E) 525 MCF/year

15. A wall has a total R-value of 15. Determine the annual cost of the heat loss per square foot in a climate having 5,000 heating degree-days. The heating unit efficiency is 70% and the fuel cost is $5.00/million BTUs.
(A) $0.057 ft^2
(B) $0.040 ft^2
(C) $0.129/$ft^2$
(D) $0.200/$ft^2$
(E) $0.029/$ft^2$

16. A 10,000 square foot building consumes the following amounts of energy per year. What is the energy budget in BTU's per square foot?
(A) 7,500 BTU/square foot Natural Gas 5,000 therms/years
(B) 88,000 BTU/square foot Electricity 60,000 kwh/year
(C) 81,500 BTU/square foot
(D) 70,500 BTU/square foot
(E) 700,000 BTU/square foot

17. Assuming that adding 2 inches of fiberglass insulation drops the U-valve of a building from 0.24 to 0.098, calculate the annual cooling savings per square foot from the data given below:
(A) $0.10/$ft^2$ 2,000 cooling degree days
(B) $0.25/$ft^2$ Cooling COP = 2.5
(C) $0.04/$ft^2$ Electrical cost $0.05/kw-hr
(D)$0.59/$ft^2$
(E) $0.02/$ft^2$

18. How many BTU/hr of fuel is wasted if 100 pound per hour condensate at 30 psia saturated liquid is drained to the sewer and is made up with water at 60 F. Assume the boiler is 80% efficient and ignore blowdown effects.
(A) 12,090 BTU/hr
(B) 15,200 BTU/hr
(C) 18,000 BTU/hr
(D) 23,855 BTU/hr
(E) 21,800 BTU/hr

19. One of the major hindrances to growth of self-help has always been
(A) Take or pay contracts
(B) Lack of enough produced natural gas
(C) FERC's unwillingness to encourage transportation pricing
(D) FERC's unwillingness to allow pipelines to "unbundle" costs

20. The time between failures of equipment without an energy management control system (EMS) is usually longer than in those situations monitored by an EMS with a maintenance schedule.
(A) True
(B) False

21. Chilled water reset saves energy because the energy required in refrigeration compressor is not a function of the chilled water's leaving temperature.
(A) True
(B) False

22. The difference between the setting at which the controller operates to one position and the setting at which it changes to the other is known as the:
(A) Throttling range
(B) Offset
(C) Differential
(D) Control Point

23. What is the flow rate of 60 F water through a control valve with a flow coefficient of 0.5 and a pressure difference across the valve of 16 psig?
(A) 2 gpm
(B) 4 gpm
(C) 6 gpm
(D) 8 gpm
(E) 10 gpm

24. With a load leveling TES strategy, a building manager will
(A) Not operate the chiller during peak hours
(B) Essentially base load the chiller (i.e., operate at high load most of the time)
(C) Operate only during the peaking times
(D) Operate in the "off" season

25. A large commercial building will be retrofitted with a closed loop water to air heat pump system. Individual meters will show costs to each department. Demand billing is a small part of the total electrical cost. Would you recommend a TES?
(A) Yes
(B) No

26. A building presently has the following lighting system:
Present 196 mercury vapor light fixtures
Size: 250 watt/lamp
285 watt/fixture, including ballast
Lamp Life: 20,000 hours/lamp
Lamp Cost: $44.00/lamp
Output: 10,000 lumens
You have chosen to replace the existing system with the following:
Proposed: 140 high pressure sodium fixtures
Size: 150 watt/lamp
185 watt/fixture
Lamp Life: 24,000 hours/lamps
Lamp Cost: $54.00/lamp
Output: 15,000 lumens
The facility operates 24 hours/day. Approximate the heating effect if the heating system efficiency is 80%, fuel costs $5.00 per million BTUs and there are 200 heating days per year.
(A) $4,445/year
(B) $2,548/year
(C) $6,986/year
(D) $5,289/year
(E) $3,068/year

27. One disadvantage to metal halide lamps is a pronounced tendency to shift colors as the lamp ages.
(A) True
(B) False

28. Given the same amount of excess air and the same flue gas temperature, which fuel provides the highest combustion efficiency?
(A) Natural Gas
(B) No. 2 Fuel Oil
(C) No. 6 Fuel Oil
(D) Coal

29. A boiler is rated at 30 boiler horsepower and 80% efficient. What is the input rating?
(A) 1,005,000BTU/hr
(B) 1,255,300BTU/hr
(C) 502, 500BTU/hr
(D) 3,628,750BTU/hr
(E) 13,400,000BTU/hr

30. A back pressure steam turbine receives 10,000 pounds per hour steam at 115 psia, 450 F. Outlet conditions of the steam turbine are 30 psia saturated. If the electrical generator is 95% efficient, how much electrical power is generated. Choose the closest answer.
(A) 227 kw
(B) 335 kw
(C) 325 kw
(D) 260 kw
(E) 244kw

31. Given the parameters below, estimate the percent outside air in this simple single zone heating system.
Outside Air Temp = 20 F
Return Air Temp = 72 F
Mixed Air Temp = 65 F
(A) 25.2%
(B) 13.5%
(C) 30.5%
(D) 5.0%
(E) 86.5%

CEM EXAM REVIEW ANSWERS

Questions – Answers	Questions – Answers	Questions – Answers
(1) – A	**(12) – D**	**(22) – C**
(2) – B	**(13) – C**	**(23) – A**
(3) – B	**(14) – E**	**(24) – B**
(4) - $112, 175	**(15) – A**	**(25) – B**
(5) – B	**(16) – D**	**(26) – E**
(6) – B	**(17) – C**	**(27) – A**
(7) – A	**(18) – D**	**(28) – D**
(8) – D	**(19) – A**	**(29) – B**
(9) – A	**(20) – B**	**(30) – E**
(10) – C	**(21) – B**	**(31) – B**
(11) - A		